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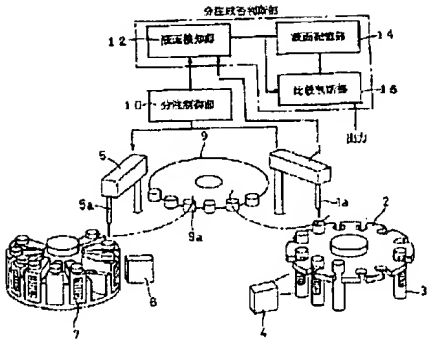
AUTOMATIC ANALYZING DEVICE

Abstract:

PROBLEM TO BE SOLVED: To lessen liquid level detection error at the time of dispensing sample.

SOLUTION: A sample dispenser is constructed so that a probe 1a with a liquid level sensor is provided on the tip of an arm mechanism, and the probe 1a is driven in the vertical direction by a pulse motor. A dispensation control part 10 controls the operation of dispensation of a sample by a sample dispenser and dispensation of a reagent by a reagent dispenser 5. A liquid level detecting part 12 detects the lowering distance of the probe 1a of the sample dispenser 1 controlled by the dispensation control part 10 from the pulse number of the pulse motor for moving a probe up and down until the liquid level sensor provided on the probe 1a detects the liquid level of a sample. The detected liquid level position is stored in a liquid level storage part 14. A comparison and decision part 16 compares the liquid level position of the sample detected by the liquid level detecting part 12 with the previous liquid level position stored in the liquid level storage part 14 at the time of the next dispensation for the same sample to decide whether the previous sample dispensation is right or wrong from the amount of change.



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(54) 【Title of the Invention】 Automatic Analyzing Device

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(57) 【Abstract】

【Problem to be Solved】

To lessen liquid level detection error at the time of sample dispensing.

【Solution】

A sample dispenser is constructed so that a probe 1a having a liquid level sensor is set on the tip of an arm mechanism, and the probe 1a is driven in the vertical direction by a pulse motor. A dispensation control part 10 controls the operation of sample dispensation by a sample dispenser 1 and reagent dispensation by a reagent dispenser 5. A liquid level detecting part 12 detects the lowering distance of the probe 1a of the sample dispenser 1 controlled by the dispensation control part 10 from the pulse number of the pulse motor for moving a probe up and down until the liquid level sensor set on the probe 1a detects the liquid level of the sample. The detected liquid level position is stored in a liquid level storage part 14. A comparison and decision part 16 compares the liquid level of the sample detected by the liquid level detecting part 12 with the previous liquid level stored in the liquid level storage part 14 at the time of the next dispensation for the same sample to decide whether the previous sample dispensation is right or wrong from the amount of change.

【Claims】

【Claim 1】 An automatic analyzing device for sample component analysis consisting of a sample dispenser which dispenses a sample from a sample container to a reaction container by a sample probe having liquid level sensor, a reagent dispenser which dispenses reagent from a reagent container to the reaction container by a reagent probe, and a determination part which determines the reaction of the reaction solution in the reaction container, wherein the device comprises a liquid level detecting part which detects the liquid level position at the time of sample dispensation by the lowering distance of the sample probe recognized by said sample dispenser, a liquid level storage part which stores the liquid level position detected by the liquid level detecting part, and a dispensation right or wrong decision part which comprises a comparison and decision part which compares a liquid level position detected by the liquid level detecting part with the previous liquid level position stored in the liquid level storage part at the time of the next dispensation of the same sample to decide whether the previous sample dispensation was right or wrong from the amount of change.

【Detailed Description of the Invention】

【0001】

【Technical Field to Which the Invention Pertains】

The present invention relates to an automatic analyzing device for sample component analysis such as an automatic biochemical analyzing device or a blood coagulation analyzing device, consisting of a sample dispenser which dispenses a sample from a sample container to a reaction container by a sample probe having a liquid level sensor, a reagent dispenser which dispenses a reagent from a reagent container to the reaction container by a reagent probe, and a determination part which determines the reaction in the reaction solution in the reaction container.

【0002】

【Prior Art】

In the sample dispenser or the reagent dispenser of automatic analyzing devices, at the time of sample or reagent dispensation into a reaction container, a bar-code reader reads a bar-code attached to the sample container or the reagent container and analysis is performed while the analyzing condition or information is automatically controlled in accordance with results read from the bar-code.

【0003】

In the sample dispensation, a sample probe descends into a sample container, when a liquid level sensor detects the liquid surface, the liquid level position is recognized from the lowering distance of the sample probe, after confirming that a sample exists in the sample container in sufficient amount for dispensation by the probe, then the probe sucks the sample and dispenses into a reaction container.

【0004】

As liquid level sensors, the one according to the system where the electrostatic capacitance change is detected at the time of contacting the probe with the liquid surface, or the one according to the system where a contact of electrodes set on the probe with the liquid surface is detected by a connection between the probe and the electrode, is generally employed.

【0005】

【Problems the Invention aims to solve】

If the dispensation is conducted only with detection of the liquid level by the liquid level sensor, liquid level detection errors are caused by various reasons. For example, (1) the liquid level sensor functions before the sensor contacts with the liquid surface due static electricity charged in a sample or a sample container, (2) erroneous detection due to foams on the sample surface, (3) erroneous detection due to dirt or liquids adhered to the container wall surface, and (4) erroneous detection due to noises entered into liquid level detection circuit. When the liquid surface is detected in spite that the liquid level sensor does not contact with the liquid surface of the sample, dispensation would not be accurately done, accordingly abnormal data are provided or lack of the sample is recognized although the sample exists in the sample container so that a reexamination is needed, it being inconvenient.

【0006】

Then, the object of the present invention is to lessen liquid level detection error by recognizing the existence of sample by the detection not only with the liquid level sensor but also by use of liquid level change.

【0007】

【Means for Solving the Problems】

According to the present invention, a dispensation right or wrong decision part which decides whether the dispensation is right or wrong based on the change of the sample liquid level in the sample container is installed. The dispensation

right or wrong decision part comprises a liquid level detecting part which detects the liquid level position of a sample from the lowering distance of a sample probe recognized by a sample dispensing apparatus at the time of sample dispensation, a liquid level storage part which stores the liquid level position detected by the liquid level detecting part, and a comparison and decision part which compares the liquid level position of the sample detected by the liquid level detecting part with the previous liquid level position stored in a liquid level storage part at the time of next dispensation for the same sample to decide whether the previous sample dispensation is right or wrong from the amount of change.

【0008】

The sample probe having the liquid level sensor of the sample dispensing apparatus descends into the sample container at the time of sample dispensation. The sample probe is driven by a pulse motor in the vertical (up and down) direction, and the liquid level of the sample in the sample container can be detected from the pulse number of the pulse motor for moving the probe up and down until the liquid level sensor detects the liquid surface of the sample. Whether the liquid level as detected is proper is decided from whether the liquid level reappears within a certain range, for example, within 1 mm, from the previous liquid level by taking into account the decrease of the liquid level by the previous sample suction.

【0009】

【Examples】

Figure 1 shows an example of an automatic biochemical analyzing device to which the present invention is applied. A reaction container 9a is placed on the circumference of a reaction disk 9, and the reaction container 9a can successively be moved to a sample dispensation position, a reagent dispensation position and a reaction determination position by rotation of the reaction disk 9.

【0010】

In order to dispense a sample into the reaction container 9a, the sample dispensing apparatus is placed (on the right) near the reaction disk 9. Sample containers 3 having bar-codes describing each identification information are placed along with the circumference of a sample disk 2 of the sample dispensing apparatus, the bar-code is read at the predetermined position by a bar-code reader 4. A sample dispenser 1 is installed for dispensation of a sample in the sample container 3 into the reaction container 9a on the reaction disk 9. The sample dispenser 1 has a

probe 1a with a liquid level sensor set on the tip of an arm mechanism, and driven such that the probe 1a moves together with the liquid level sensor between the sample container 3 at the predetermined position, a sample dispensation position on the reaction disk 9 and a washing position where the probe 1a is washed. The probe 1a is driven in the vertical (up and down) direction by the pulse motor. After the bar-code attached to the sample container 3 is read by the bar-code reader 4, the content of the bar-code is compared with the sample identification information previously stored in a control part so that the sample in the specific sample container is identified automatically.

【0011】

In order to dispense a reagent into the reaction container 9a, a reagent dispensing apparatus is placed (on the left) near the reaction disk 9. Reagent containers 7 are placed along with the circumference of a reagent disk 6 of a reagent dispensing apparatus, and bar-code showing contents of the reagent is attached to each reagent container 7. The bar-code is read at the predetermined position by a bar-code reader 8. Reagent dispenser 5 which dispenses a reagent into the reaction container 9a has the same arm mechanism as that of the sample dispenser, and a probe 5a with a liquid level sensor is installed on the tip of the arm mechanism. The arm mechanism is driven so that the probe 5a moves between the reagent container 7 at the predetermined position, a reagent dispensation position on the reaction disk 9 and a wash position where the probe 5a is washed. The bar-code attached to the reaction container 7 is read by a bar-code reader 8, and compared with the reagent identification information previously stored in the control part so that analyzable items and suction positions are recognized automatically.

【0012】

The dispensation control part 10 controls operations of the sample dispensation by the sample dispenser 1 and the reagent dispensation by the reagent dispenser 5. The liquid level detecting part 12 detects the lowering distance of the probe 1a of the sample dispenser 1 controlled by the dispensation control part 10 from the pulse number of the pulse motor for moving a probe up and down until the liquid level sensor provided on the probe 1a detects the liquid surface of the sample. The detected liquid level position is stored in the liquid level storage part 14. The comparison and decision part 16 compares the liquid level position of the sample detected by the liquid level detecting part 12 at the time of the next dispensation to

the previous liquid level position stored in the liquid level storage part at the time of the next dispensation for the same sample to decide whether the previous sample dispensation is right or wrong from the amount of change.

【0013】

The operation according to this example, which decides whether the sample dispensation is right or wrong shall be explained with reference to a flow chart described in Figure 2. When the sampling operation is started, the probe 1a descends into the sample container 3 containing a sample and the liquid level sensor set on the probe 1a detects the liquid surface of the sample in the sample container, the sample liquid level is detected from the lowering distance of the probe 1a from the pulse number of the pulse motor for moving the probe up and down and stored in the liquid level storage part 14.

【0014】

When the sample dispensation is for the first item of the sample and when the analysis includes only one item, reexamination is appointed and a flag which shows the analysis datum to be withheld is stood thereon. Then, the normal sample liquid level at the time of the next dispensation of the same sample is set, and an appropriateness decision criteria of the liquid level, for example within 1 mm, is set. When the analysis includes the next item for the same sample, the sampling operation is repeated for the same sample.

【0015】

The liquid level at the time of second dispensation is similarly detected from the lowering distance and compared to the liquid level stored in the liquid level detecting part 14 (translator's note: this might be "liquid level storage part 14"), and when it falls within the appropriate decision criterion, it is decided that the dispensations at the previous time and this time are both appropriately done. In this case, the previous analysis datum which was withheld and the data this time are decided as normal, and both analysis data are reported as proper results.

【0016】

Analysis for subsequent items are performed while it is decided whether the liquid level is appropriate based on the previous normal liquid level, and reexamination procedures are done in case of inappropriate liquid level. Namely, if the liquid level at the time of the second dispensation does not fall within the appropriateness decision criteria, the first analysis item is appointed as the subject

to reexamination as well as a flag showing analysis data to be withheld is stood on the data this time and the next item is subjected to analysis. At the time of analysis for the next item, it is decided whether the previous data is normal, and when the liquid level is inappropriate at the analysis for the item, appointment of reexamination for this analysis item and data withholding are repeated as well.

【0017】

The data of single item analysis always undergo reexamination procedures, and it is decided at the time of the next analysis for the same sample whether the sample dispensation is appropriate. Because reexamination decreases dispensation capacity, it is possible to attach only an indication that the data are inappropriate to the data which are decided to be inappropriate at the time of next dispensation. Further, in case of detection errors due to lack of sample or probe collisions, automatic reexamination may be performed by deciding appropriateness of liquid level.

【0018】

【Effects of the Invention】

According to the present invention, the sample liquid level position is detected from the lowering distance of the sample probe at the time of the sample dispensation, and the liquid level position at the time of the next dispensation of the same sample is compared with the previous liquid level position to decide whether the previous sample dispensation is right or wrong. Therefore, the liquid level detection errors caused when the existence of a sample in a sample container is detected only by liquid level sensor can be avoided.

【Brief Description of Drawings】

【Figure 1】

A perspective view of main components of an example showing a block diagram of a dispensation control part and a dispensation right or wrong decision part.

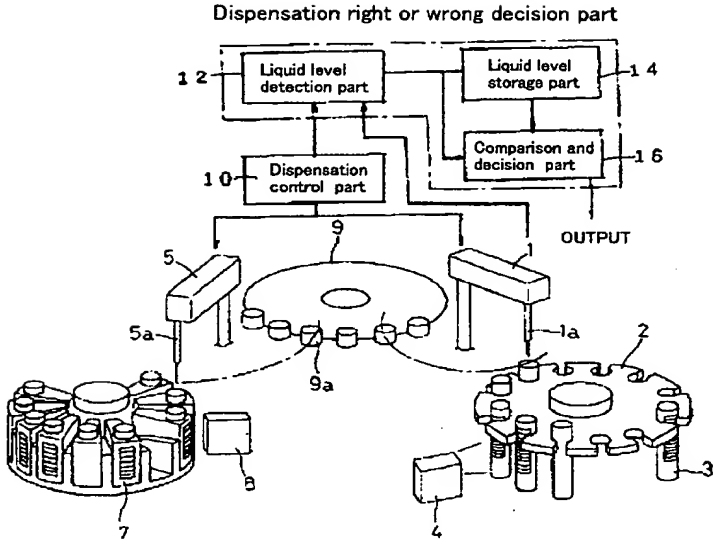
【Figure 2】

A flow chart which shows an example of operation.

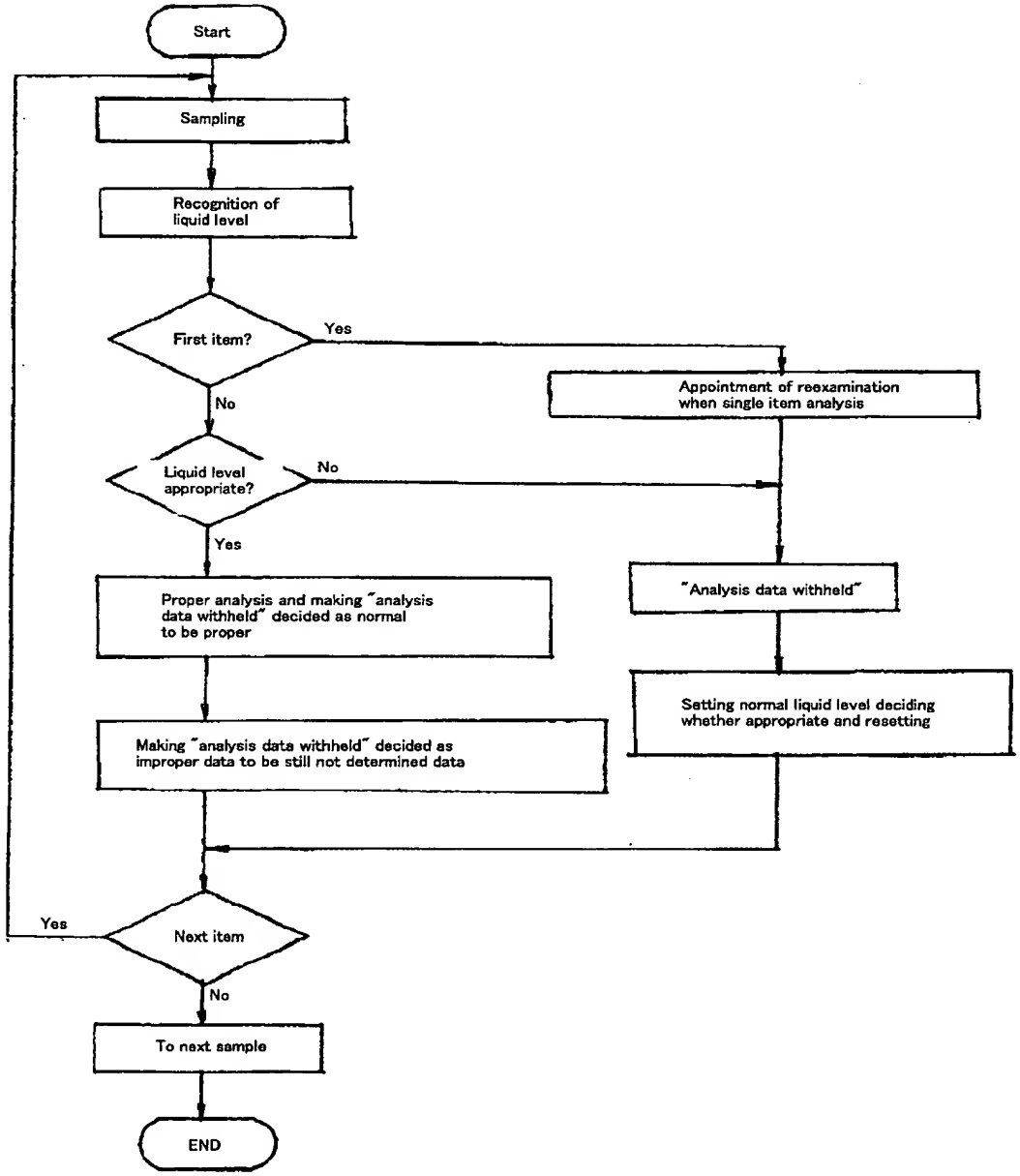
【Explanations of letters or numerals】

1: sample dispenser, 2: sample disk, 3: sample container, 5: sample dispenser, 10: dispensation control part, 12: liquid level detecting part, 14: liquid level storage part, 16: comparison and decision part

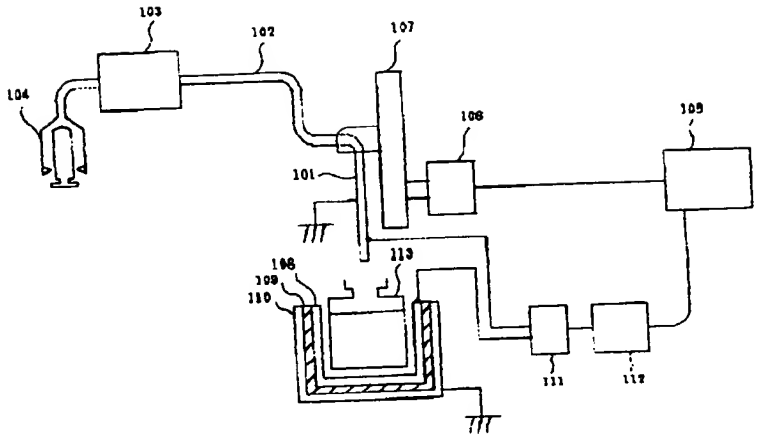
【Fig. 1】


Dispensation right or wrong decision part
12
Liquid level detection part
Liquid level storage part
14
Comparison and decision part
16
10
Dispensation control part
OUTPUT
9
5
1
5a
1a
2
9a
3
8
7
4

【Fig. 2】


Start
Sampling
Recognition of liquid level
First item?
Yes
No
Appointment of reexamination when single item analysis
Liquid level appropriate?
No
Yes
"Analysis data withheld"
Proper analysis and making "analysis data withheld" decided as normal to be proper
Setting normal liquid level deciding whether appropriate and resetting
Making "analysis data withheld" decided as improper data to be still not determined data
Yes
Next item
No
To next sample
END

【Fig. 1】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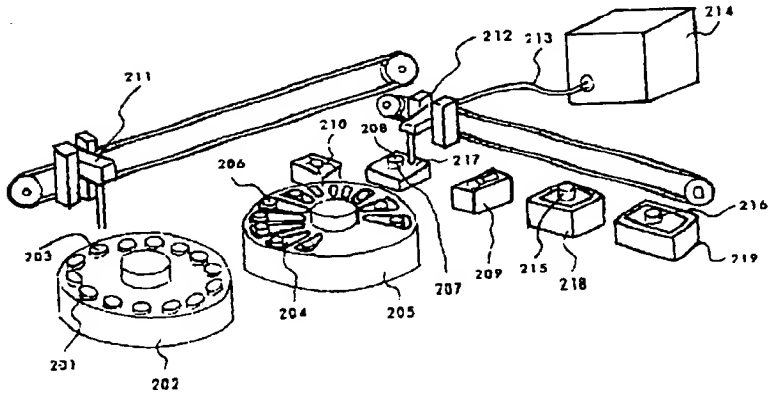
【Fig. 2】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